Optical Imaging Swept Laser | s3

Applications

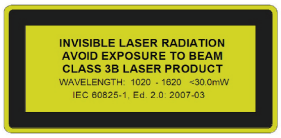
- Optical Frequency Domain Ranging
- Optical Coherence Tomography
- Chromatic Confocal Microscopy
- Optical Spectroscopy
- Fiber-optic Sensing

Description

The Micron Optics s3 is an Optical Imaging Swept Laser module that provides linear sweep in optical frequency and customizable tuning ranges across the 1060nm, 1310nm or 1550nm wavelength windows. To facilitate system integration, the laser module also provides crucial triggering signals corresponding to the sweep signal, calibration comb frequency, and user designated wavelengths. The flexibility of the s3 makes it very useful for applications in bio-medical and industrial imaging, optical frequency domain ranging, as well as optical sensing and spectroscopy.

Features

- 1060, 1310 or 1550nm spectral regions
- 1KHz to 4KHz sweep frequency
- Linear frequency sweep
- Custom spectral ranges
- High resolution
- Programmable calibration triggers
- Compact, rugged and portable
- Custom OEM designs available



Specifications α [1]

Optical Properties			
Wavelength Window	1060nm	1310nm	1550nm
Maximum 3-dB Sweep Range [2]	40nm	100nm	130nm
Drive Frequency	1 to 4KHz		
Duty Cycle [3]	10% to 100%		
Scan Waveform	Triangular		
Frequency Sweep Non-Linearity [4]	< 1% (over 90% duty cycle)		
Average Sweep Speed Non-Linearity [4]	eg.: +/- 5% (over 90% useful range)		
Dynamic Linewidth [5]	10 to 100 pm +/- 20%		
Maximum Average Optical Output [6]	30mW		
Optical Output Isolation	30dB		
Wavelength markers	User defined starting & ending wavelengths		
Electrical Properties			
Scan waveform	Triangle		
SYNC	TTL, Corrresponds to drive waveform		
Wavelength Gate Signal	TTL, Corrresponds to user defined starting & ending wavelengths		
Sampling Clock [7]	TTL, Corrresponds to internal optical comb reference		
Power			
Input Voltage	7-36VDC		
AC/DC Converter	Included (100~240VAC, 47~63Hz)		
Mechanical			
Operating Temperature	Room Temperature		
Storage Temperature	-5˚ C to 55˚ C		
Diameter	132 mm x 267 mm x 135mm		

Notes:

1. Alpha Prototype. For more detailed description see www.micronoptics.com/product_designation.php.
2. Customizable (eg: 10nm to 150nm)
3. Laser-on time over sweep time.
4. Dependent on sweep duty cycle. P-scan specification.
5. Customizable (eg: 10pm to 100pm)
6. Within the active duty cycle.
7. Customizable comb frequency spacing with sub-interval sampling option.

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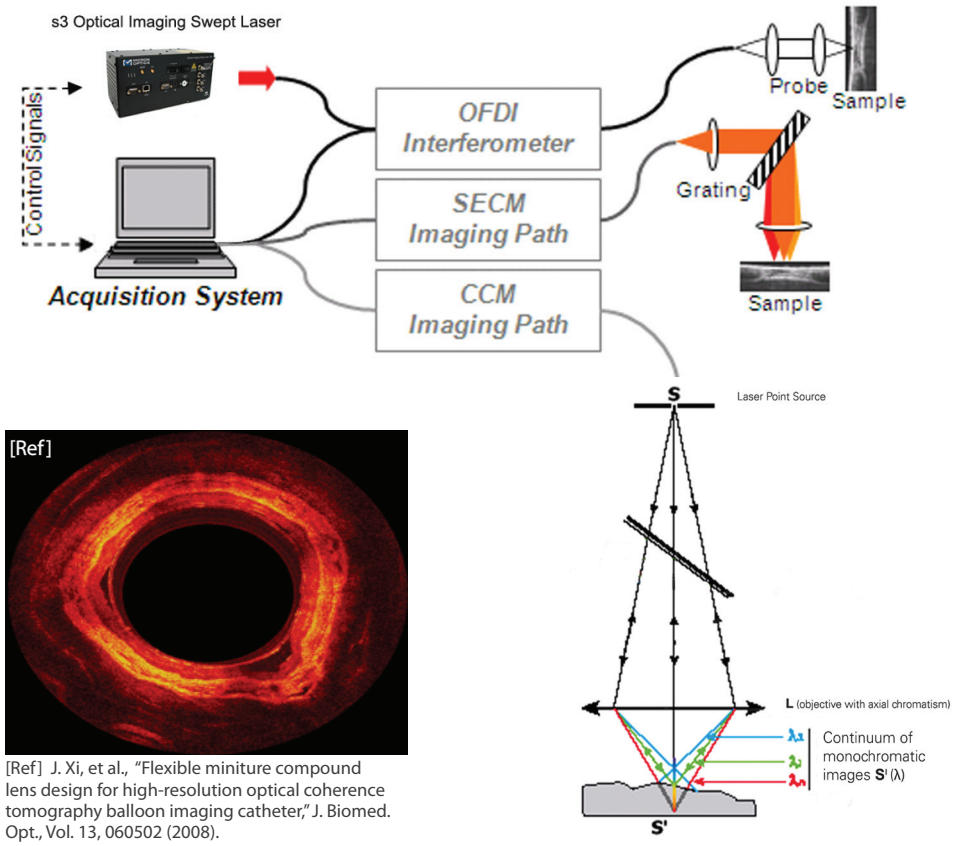

[Ref] J. Xi, et al., "Flexible miniture compound lens design for high-resolution optical coherence tomography balloon imaging catheter," J. Biomed. Opt., Vol. 13, 060502 (2008).

Application Examples

Applications Optical Frequency Domain Imaging (OFDI):

The basic OFDI system consists of 3 functional blocks: the swept source, the acquisition system, and the imaging probe formed by the Michelson interferometer. In addition to near linear sweep, the s3 also provides sync trigger, wavelength marker, and real-time uniform-frequency sampling clock to facilitate signal acquisition and system synchronization. This alleviates the need for recalibration via post processing.

Spectrally Encoded Confocal Microscopy (SECM):

Swept spectrum from s3 is transmitted through the distal diffraction grating and objective lens, and converted to a line scanning spot across the sample. The reflected optical signal is focused back through the optical fiber and detected remotely. Spatial information along the sample is decoded by measuring the spectrum of light, thereby enabling confocal microscopy without a mechanical scanner at the distal end of the probe.

Chromatic Confocal Microscopy (CCM):

s3 swept wavelength output is imaged by a chromatically dispersive lens into a fast scanning axial spot illuminating into the sample. The reflected optical signal is focused back through the optical fiber and detected remotely to enable high resolution non contact 3D surface metrology including roughness characterization and surface flaw detection.

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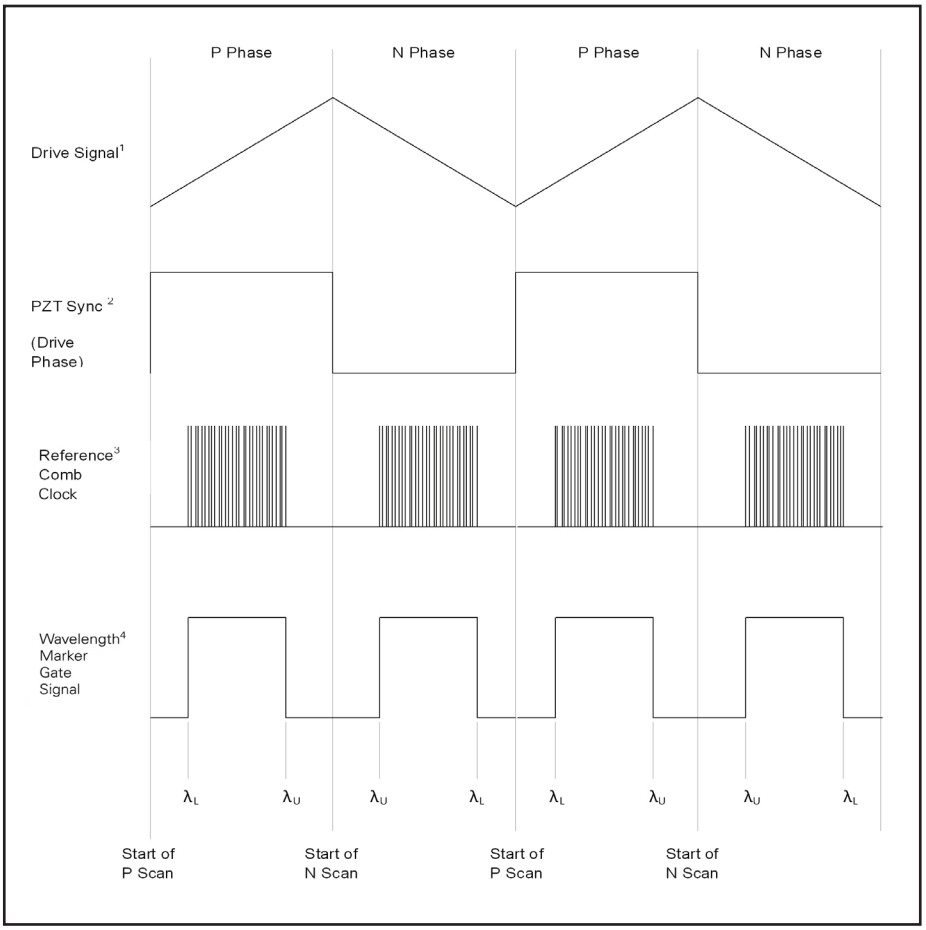

This chart illustrates useful trigger, calibration, and clock signals.

1. The PZT Drive voltage is applied to sweep laser wavelength. Tuning wavelength (λ) increases with increasing drive voltage. This is the P-phase of the scan. Similarly, tuning wavelength decreases with decreasing drive voltage. This is the N-phase of the scan.
2. The PZT Sync Signal corresponds to drive phase, and can be used to trigger data acquisition, or as a control signal.
3. The Reference Comb Clock signal is spaced uniformly in optical frequency, and can be used as sampling clock or calibration signal.
4. The Wavelength Marker Gate Signal corresponds to the custom specified lower wavelength (λL) and upper wavelength (λU) transition during a sweep. This marker signal can be specified any where within the laser sweep range.

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